REMARKS/ARGUMENTS

Claims 56-59, 73-76, 78-83, and 96-97 remain pending in the instant application. Claims 60-64 and 84-95 are withdrawn from consideration pursuant to Examiner's restriction requirement and Applicant's election. Claim 98 is added and claims 68 and 78 are made dependent on Claim 98.

Amendments to the Claims

As amended above, independent claim 56 recites

> ...along a first curvilinear transverse direction along a contactor surface, ~~the fluid contactor, and one or more~~ one of:
> the distribution of orifice spatial locations is nonuniform;
> the distribution of orifice size is nonuniform; and
> the distribution of orifice orientation is nonuniform;
> and wherein the apparatus orifice distributions ~~non-uniform distributions of the spatial locations, of areal density, size, and orientation of the orifices~~ are configured to deliver...
>
> (markup per 37 C.F.R. § 1.121)

In addition, claim 56 recites "an elongated ~~a~~ fluid contactor" (markup per 37 C.F.R. § 1.121), and subsequent references to the elongated fluid contactor in claims 56 and its dependents are similarly amended. These features are fully supported throughout the original specification as filed, and no new matter has been added

New dependent Claim 98 is added, namely:

> The apparatus of claim 56, further comprising at least one of a elongated fluid contactor having a plurality of portions comprising outlet orifices, and a plurality of elongated fluid contactors comprising outlet orifices, wherein at least one of the fluid contactor and the outlet orifices are configured such that along a second curvilinear transverse direction, the distribution of orifice areal density between the outer portions or outer contactors is non-uniform.

Consequently, dependency of Claims 68 and 78 are shifted from claim 56 to claim 98. New claim 98 reads on the elected invention. No new matter has been added.

{00971339.1}

Rejection Under 35 U.S.C. § 112

Claims 56-59, 65-83 and 96-97 are rejected under 35 U.S.C. § 112, second paragraph, as indefinite for use of the phrase "being configured" or "are configured". Applicant respectfully traverses the rejection.

The standard to be applied is whether the claim would apprise one of ordinary skill in the art of its scope. "If the claims read in light of the specification reasonably apprise those skilled in the art of the scope of the invention, Section 112 demands no more." *Solomon v. Kimberly-Clark Corp.*, 16 F.3d 1372, 55 USPQ2d 1279, 1282 (Fed. Cir. 2000). The instant rejection is grounded solely on the basis that Applicant used functional language (e.g., "being configured to..." or "are configured to...") to define the recited structure, not based upon any ambiguity in that functional language. However, rejections so based cannot stand. "Applicant may use functional language... As noted by the court in *In re Swinehart*, 439 F.2d 210, 160 USPQ 226 (CCPA 1971), a claim may not be rejected solely because of the type of language used to define the subject matter for which patent protection is sought." M.P.E.P., 8th Ed., Rev. 6, § 2173.01 (Sept 2007).

However, in the interest of advancing prosecution, and without acquiescing in the propriety of the rejection, independent claim 56 is amended to recite, *inter alia*,

> ...along a first curvilinear transverse direction along a contactor surface, ~~the fluid contactor, and one or more~~ one of:
> the distribution of orifice spatial locations is nonuniform;
> the distribution of orifice size is nonuniform; and
> the distribution of orifice orientation is nonuniform;
> and wherein the apparatus orifice distributions ~~non-uniform distributions of the spatial locations, of areal density, size, and orientation of the orifices~~ are configured to deliver...
>
> (markup per 37 C.F.R. § 1.121)

These amended features of claim 56 are fully supported throughout the original specification as filed, and no new matter has been added. As will be apparent to one of ordinary skill in the art, these amendments define, in the alternative, structural aspects of the apparatus recited in claim 56, and not only functional characteristics. Therefore, irrespective of the merits of the rejection, Applicant respectfully submits that it is obviated by the foregoing amendments, and kindly requests favorable reconsideration and withdrawal.

{00971339.1}

Rejection Under 35 U.S.C. § 102

Claims 56-59, 73-76, 78-83 and 96-97 are rejected under 35 U.S.C. § 102(b) as anticipated by U.S. Patent No. 6,183,240 to Döbbeling, *et al.* ("Döbbeling"). Applicant respectfully traverses the rejection.

Amended independent claim 56 recites an apparatus for mixing a first fluid in a second fluid, comprising, *inter alia*,

> "an elongated fluid contactor which forms a flow path for the first fluid from which the first fluid is delivered into [a] duct...
>
> wherein along a first curvilinear transverse direction along a contactor surface, one of:
> the distribution of orifice spatial locations is non-uniform;
> the distribution of orifice size is non-uniform; and
> the distribution of orifice orientation is non-uniform;
> and wherein the apparatus orifice distributions are configured to deliver at least one of
> a prescribed non-uniform transverse distribution of the first fluid in the second fluid;
> a prescribed non-uniform streamwise distribution of the first fluid in the second fluid;
> a prescribed non-uniform transverse distribution of a ratio of the first fluid to the second fluid, by mass or by volume; and
> a prescribed non-uniform streamwise distribution of a ratio of the first fluid to the second fluid, by mass or by volume,
> the non-uniform distribution being taken at a plurality of locations along a curvilinear path transverse to the second flow, or streamwise along the second flow direction, respectively.

These features are neither taught nor suggested by Döbbeling.

The Office Action asserts that "A desired flow distribution of air is provided by a plurality of outlet orifices 32 and 19, 20, which is seen, is non-uniform in distribution across the flow region since the outlets are peripheral and differ in number along the distribution region."

In light of amended claim 56, Applicant respectfully submits that Döbbeling does not teach or suggest forming orifices with a non-uniform pattern along an elongated fluid contactor surface, in spacing, size, or orientation.

Moreover, Döbbeling discloses "A burner for operating a unit for generating a hot gas consists essentially of at least two hollow partial bodies (1, 2) which are interleaved in the flow direction and whose center lines extend offset relative to one another in such a way that adjacent walls of the partial bodies (1,2) form tangential air inlet ducts (5, 6) for the inlet flow of

combustion air (7) into an internal space (8) prescribed by the partial bodies (1, 2)." See, Abstract.

Orifice Spacing:

The Office Action states that "the orifices 34 and 19 in figure 4 are spatially disposed in a non uniform pattern." Applicant respectfully submits that Döbbeling does not teach non-uniform spacing of orifices along the fluid contactor surface according to amended Claim 56.

Note that Döbbeling specifically claims that the air injection jets are equidistantly spaced, i.e., they are uniformly distributed along the fluid contactor (see, claim 15). Döbbeling states "A plurality of nozzles 32 of circular cross section are arranged on the inside of the burner outlet 17." Claim 15 of Döbbeling requires: ". . .several distinct jets in a preferably equidistant distribution around the circumference of the burner." In Fig. 4, orifices 19 are uniformly spaced around the end plate. Variations in the peripheral number of orifices across the end plate are due to physical limitations of positioning discretely sized orifices in limited space. Any apparent variation in spacing of nozzles 32 shown in Döbbeling Fig 2 is a sinusoidal variation due to the elevation projection. The air jet arrows 34 in Fig. 4 are positioned between every second end plate orifice 19. Since Döbbeling teaches equidistant orifice spacing, the orifices 32 forming jets 34 are, in fact, uniformly spaced around the periphery of the conduit manifold 2.

Thus, Döbbeling does not teach spacing orifices non-uniformly along the fluid contactor; "wherein along a first curvilinear transverse direction along a contactor surface, . . . the

distribution of orifice spatial locations is non-uniform;"

Orifice Size:

Döbbeling teaches constraining orifice size above a lower boundary layer based limit, and below an orifice spacing limit, namely:

"Furthermore, particularly effective suppression has been found when the maximum diameter D of the nozzles is greater than approximately a quarter of the boundary layer thickness .delta. in the region of the nozzles. . . . For a typical burner, the boundary layer thickness is approximately 1 mm."

"It has also been found to be advantageous for the maximum diameter D of the nozzles to be smaller than approximately a fifth of the distance s between adjacent nozzles."

Orifices in FIG. 1 and FIG 4 appear uniformly sized. Döbbeling does not mention "size" or "area". Thus Döbbeling does not teach configuring orifices with non-uniform orifice size distributions wherein "the distribution of orifice size is non-uniform;"

Orifice Angle:

Döbbeling describes "Air 34 is injected through the nozzles 32 at right angles to the flow direction 30 in a plane at right angles to the flow direction." "The flow direction of the perturbation air 34 emerging from the nozzles 32 (not shown in FIG. 4) points radially inwards in this embodiment example." In Fig. 2 and Fig 3, Döbbeling shows orifices 32 aligned at angles phi (φ) or alpha (α). However, al jets are shown at the same angle with no apparent non-uniform variation along the fluid contactor.

Döbbeling discloses "The invention, is based on the object of creating an appliance which permits effective suppression of thermoacoustic vibrations and is associated with the smallest possible design complication." The reference makes no mention of "uniform", nor of "nonuniform", nor "linear", nor "nonlinear", nor "ratio", nor "stoichiometric", nor "spacing". Reference 34 of Döbbeling are not orifices, but represent air flow.

Thus, Döbbeling does not teach configuring orifice orientations along a fluid contactor wherein "the distribution of orifice orientation is non-uniform" as in Claim 56.

In contrast to the present claims, Döbbeling does not mention "transverse" in any sense. The only use of "distribution" is in claim 15 "additional air is injected into the burner as several distinct jets in a preferably equidistant distribution around the circumference of the burner."

The Office Action states "With regards to the mass flow rate volumes of flow, the flow rates provided of the 1st and 2nd flows are dependent upon the flow pressures operated by the device and does distinguish the in a structural sense." However, Döbbeling's only reference to "pressure" outside the Background is simple nozzle descriptor "The fuel injection arrangement can involve an air-blast nozzle or a nozzle operating on the pressure atomization principle." Even in the Background, Döbbeling only refers to the acoustic control relevant art: "They lead to high-amplitude pressure fluctuations, . . ." "It is similarly suitable to modulate the fuel mass flow. In this procedure, fuel is injected into the burner with a phase shift relative to measured

signals in the combustion chamber (for example, relative to the pressure) so that additional heat is released at a pressure minimum. This reduces the amplitude of the pressure vibrations."

Applicant respectfully submits that Döbbeling gives no teaching or suggestion on controlling either 1st or 2nd flows, or the ratio of first to second fluid flows, other than the phase control of fuel relative to the amplitude of pressure vibrations, or generic air blast nozzles.

As illustrated above, Döbbeling does not teach or suggest an apparatus for delivering fluid through a fluid contactor comprising orifices with non-uniform spacing, size, or orientation distribution. Furthermore, Döbbeling does not teach how to configure said orifices so as to have a prescribed distribution in fluid mixing, as recited in independent claim 56. Claims 57-59, 73-76, 78-83, and 96 to 98 each depend, either directly or indirectly, from independent claim 56. These dependent claims are each separately patentable, but in the interest of brevity, they are offered as patentable for at least the same reasons as their underlying independent base claims, the features of which are incorporated by reference. Therefore, Applicant respectfully submits that the rejection has been obviated, and kindly requests favorable reconsideration and withdrawal of the rejection.

Claims 56-59, and 73-83, and 96-97 are rejected under 35 U.S.C. § 102(b) as anticipated by U.S. Patent No. 3,734,111 to McClintock ("McClintock"). Applicant respectfully traverses the rejection.

Orifice Spacing:

Examiner objects: "The manifold feed openings are non-uniform in distribution across the flow region since the outlets 3 are lie across and about the contactor conduit manifold 2 and differ in number an spacing distributed along the surface of the manifold."

McClintock's only mention of "spaced" or "spacing" is in Claim 1: "sparging pipe means perforated to emit a flow of sparged fluid at points spaced across the internal diameter of the pipe section, . . ." This provides no teaching as to the orifice spacing. The only information on orifice spacing provided by McClintock is in Example II: "the sparger pipe was extended to within two inches of the side wall of the 24 inch pipe opposite the inlet side and three-eighth inch diameter perforations on 1-1/2 inch centers were extended down both sides and around the end of the sparger pipe to emit a flow perpendicular to the fluid flow in the pipe." i.e. equidistant

spacing of orifices on 1 ½ inch centers along the sides of the sparging pipe.

In contrast to the features recited in independent claim 56, McClintock provides no basis for a teaching or suggestion that the orifices 3 on pipe 2 are non-uniformly spaced along the fluid contactor. Rather, one finds explicit teaching that the orifices are on (equal) 1 ½ inch centers.

The teaching regarding spacing on the sparger cap 5 is:

"Additional fluid is sparged through the perforated cap 5 which is located within the throat of the frusto-conical baffle . . ." "The number and size of the perforations in this cap are determined by the balance of flow desired between this cap and the elongated sparger holes."

In absence of specific teaching on spacing, the spacing of "perforations" 3 or orifices in the perforated cap 5, we consider the spacing but an artist's rendition of providing perpendicular lines of four orifices each with four additional perforations at the bisecting lines around the perforated cap. There appears to be no teaching regarding spacing on the cap 5 other than that inferred from the linear equidistant spacing of holes 3 in the sparger 2, and the apparent symmetry in orifice spacing over cap 5.

From Fig. 3, Orifices 3 on cap 5 appear to be equally distributed in a spherical array on the cap 5. e.g., orifices are positioned on lines at 0-180 and 90-270 degree orientations along an upstream circular orifice line, and a downstream circular orifice line. In the upstream line supplementary orifices added at 45-225 degrees, and 135 – 315 degree orientations. Thus orifices 3 on cap 5 are uniformly distributed along both upstream and downstream orifice lines around cap 5.

Thus, McClintock provides no teaching on nonuniform spacing as taught in Claim 56 such that:

"wherein the distribution along a first curvilinear transverse direction along a contactor surface
of . . . the distribution of orifice spatial locations is non-uniform;"

Orifice Orientation:

Regarding perforation orientation, McClintock teaches: "Another fluid is sparged into the perforated, elongated sparger 2 to be emitted through holes 3 perpendicular to the flow of fluid in the pipe section." McClintock gives no teaching on configuring orifices 3 in the sparging tube 2 other than the equally spacing and perpendicular orientations to the flow as shown in FIG. 1. The configuration of perforations is taught as:

"Location of the sparger holes is on a line down each side of the sparger, and in one embodiment around the capped end, to emit sparged fluid perpendicular to the flow of fluid in the pipe section." From the artists' depiction in Fig 3 and Fig. 4, the orifices appear to be oriented perpendicularly to the surface of Cap 5.

McClintock provides no teaching on nonuniform orifice orientation of Claim 56 that: "wherein the distribution along a first curvilinear transverse direction along a contactor surface

of . . . the distribution of orifice orientation is non-uniform;"

Orifice Size:

In Example II, McClintock teaches providing "three-eighth inch diameter perforations on 11/2 inch centers were extended down both sides and around the end of the sparger pipe to emit a flow perpendicular to the fluid flow in the pipe."

McClintock provides no teaching on nonuniform orifice sizing such that: "wherein the distribution along a first curvilinear transverse direction along a contactor surface

of . . .the distribution of orifice size is non-uniform;"

Therefore, Applicant respectfully submits that McClintock provides no teaching on a variation of orifice sizes as taught in Claim 56 as amended above such that:

"the distribution of orifice size is non-uniform"

While McClintock provides a perforated frusto-conical baffle coaxially aligned with the pipe section" 4, this is a downstream mixing element and not a fluid contactor configured with orifices. Moreover, as amended above, claim 56 recited an elongated fluid contactor. By contrast, McClintock discloses a hemispherical sparger cap (5), not an elongated fluid contactor. Therefore, Applicant respectfully submits that claim 56 is further patentably distinguished over McClintock on the basis of this structural feature of claim 56.

As to nonlinear fluid distributions, McClintock does not mention "linear", nor "nonlinear", nor "distribution", nor "homogeneous", nor "inhomogeneous", nor "transverse", nor "concentration". The only mention of "ratio" is in the Table, Col. 3 line 58, 59, referring to the average "Steam/butane mol. ratio", and "air/butane mol. ratio". No mention is made of any control of or variation in the fluid ratio transverse to the flow in pipe 1.

Thus claims 56-59, 73-83, and 96-97 are not anticipated by McClintock, as McClintock does not teach apparatus comprising non-uniform distributions of orifice spacing, size or

orientation along a fluid contactor. Furthermore, McClintock does not teach configuring orifices with non-uniform distributions of spacing, size or orientation to obtain non-linear flow delivery distributions or ratios of flows along curvilinear paths transverse to the flow. Favorable reconsideration and withdrawal of the rejection is kindly requested.

Claims 56-59, 70, 72-75, 81-83 and 96-97 are rejected under 35 U.S.C. § 102(b) as anticipated by U.S. Patent No. 4,273,527 to Meenan ("Meenan"). Applicant respectfully traverses the rejection.

Regarding "mix", Meenan states "Since one source of fuel used in the system 10 is pulverized material, proper mixture of gas and air throughout the length of the system 10 is necessary to insure proper combustion"; and ". . . supply tubes 20 and 22 that are connected to a source of pressurized gas such as a premix burner." Premix burners commonly seek uniform premixing. This inexorably leads one of ordinary skill in the art to understand that homogeneous and uniform mixing within the combustion chamber 28 as "necessary" "throughout the length" of system 10 according to Meenan.

Orifice Spacing:

Regarding orifices or "jet openings 26" and "jet openings 30", Meenan states "Around the inner periphery of each conduit 12A and 12B of the set of tubular conduits 12 are a series of jet openings 26 directed inwardly to the combustion chamber 28 to allow the passage of air into the chamber 28 along the entire length thereof. Similarly, each conduit 18A and 18B of the second set of tubular conduits 18 also includes a series of jet openings 30 extending along toward the combustion chamber 28 to allow the passage of gas from the set of tubular conduits 18 into the combustion chamber 28 along the entire longitudinal length thereof." Any apparent variation of orifice spacing shown in Fig. 2 appears to be due to the sinusoidal spacing appearance of projection of uniform spacing onto an elevation drawing.

Thus, Meenan provides no teaching on nonuniform spacing as taught in Claim 56 such that: "wherein the distribution along a first curvilinear transverse direction along a contactor surface of . . . the orifice spatial locations is non-uniform;"

Orifice Size:

Meenan does not mention size, area, orifice or perforation nor does it refer to nozzle diameter.

Orifices in the fluid conduits 12A, 12B, 18A and 18B in Meenan FIG. 1 and FIG 2 appear uniformly sized. Meenan's tubes 42, 44 and 47 appear to have single nozzles. Thus Meenan does not teach configuring orifices with non-uniform orifice size distributions along a fluid contactor as in Claim 56, wherein "the distribution of orifice size is non-uniform;"

Orifice Orientation:

Applicant respectfully submits that Meenan teaches only uniformly spaced peripheral jets oriented radially into the combustion chamber. It apparently gives no instruction on orientations other than radially oriented jets, nor any explicit description of spacing other than apparent uniform peripheral spacing in perforated cylindrical tubes uniformly spaced along the combustor. It gives no instruction on differing penetrations of jets into the flow. Meenan only shows perforated tubes peripheral to the flow, not distributed across the flow.

Thus, Meenan does not teach configuring orifice orientations along a fluid contactor wherein "the distribution of orifice orientation is non-uniform" as in Claim 56.

Meenan makes no reference to "uniform" nor "nonuniform" nor "homogeneous", nor "inhomogeneous", nor "distribution", nor "transverse", nor "ratio", nor "stoichiometric", nor "composition". The only reference to "axial" is: "A first nozzle 40 is coaxial with and lies along the axis of the cylindrical combustion chamber 28." Accordingly, Applicant respectfully submits that Meenan further does not anticipate non-uniform configuration of the apparatus orifice spacing, size or orientation along fluid contactors to obtain the non-uniform fluid distributions transverse to the flow of revised Claim 56 above, and consequently of the subsequent dependent claims. Favorable reconsideration and withdrawal of the rejection is kindly requested.

With respect, the examiner's comments from "a 2nd fluid flow path for a primary fluid 7, . . . in the hemisphere 5 or cylinder 2" appear to be a duplicate of and relate to the discussion of McClintock, and do not address Meenan.

Rejections Under 35 U.S.C. § 103

Claims 65-67 and 71 are rejected under 35 U.S.C. § 103(a) as obvious over Meenan in view of U.S. Patent No. 4,176,637 to Cole ("Cole"). Applicant respectfully traverses the rejection.

Claims 65-67 and 71 each depend, either directly or indirectly from independent claim 56, and incorporate its features by reference. As shown above, Meenan does not anticipate the amended claim 56. Furthermore, Cole does not offer, nor is it alleged to, any teaching or suggestion to ameliorate the deficiencies of Meenan with respect to underlying amended independent base claim 56. Cole makes no reference to a fluid contactor comprising a plurality of orifices wherein

> ...along a first curvilinear transverse direction along a contactor surface, one of: the distribution of orifice spatial locations is non-uniform;
> the distribution of orifice size is non-uniform; and
> the distribution of orifice orientation is non-uniform;

Furthermore, Cole makes no reference to "uniform", "nonuniform", "linear" or "nonlinear", "distribution", "spacing", "angle", "orientation." Cole does not teach use of a second nozzle or multiple orifices. Even presuming that Cole teaches what is attributed to it, and further that there is some apparent reason for one of ordinary skill in the art to combine the references as proposed in the Office Action, the references, taken singly or in combination, do not teach or suggest all features recited in the claims. Accordingly, Applicant respectfully submits that neither Meenan or Cole make obvious amended claim 56 above, and consequently they do not make obvious either of dependent claims 65-67.

However turning specifically to the rejected claims, first claim 66, Cole makes no mention of "the applied high voltage is within a desired range to reduce the cross sectional area of the first fluid after it passes through said orifices without causing an arc" as recited in Claim 66. With regard to claim 67, Cole teaches "If the electrical source is AC current, a suitable rectifier circuit as described is provided to convert the AC to DC potential." Cole makes no mention of "oscillate" or "fluctuate", or "dynamic". Cole does not teach how to provide a "fluctuating voltage within a prescribed range to oscillate the delivered first fluid flow" as in claim 67.

With regard to claim 71, the flexible manifold was taught in reference to the non-elected species of Claims 63 and 64. As described in the previous response, Claim 71 is corrected from "flexible manifold" to "flexible support" to correspond to the currently elected species, to read as follows:

> The apparatus of claim 56, wherein said fluid contactor comprises a flexible <u>support</u> ~~manifold~~ for connecting said fluid delivery system to said plurality of orifices.
> (underline and strikethrough per 37 C.F.R. 1.121)

In light of the foregoing, Applicant respectfully submits that the rejection over Meenan and Cole has been obviated, and kindly requests favorable reconsideration and withdrawal.

Claims 68-69 and 76-80 are rejected under 35 U.S.C. § 103(a) as obvious over Meenan in view of Döbbeling. Applicant respectfully traverses the rejection.

Claims 68-69 and 76-80 each depend from independent claim 56, and incorporate its features by reference. As illustrated above, neither Meenan nor Döbbeling teach or suggest the features of claim 56. Their proposed combination does not ameliorate their respective deficiencies. Therefore, the references, taken singly or in combination, do not teach or suggest all features recited in the claims. To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). Accordingly, Applicant respectfully submits that neither Meenan nor Döbbeling make obvious amended claim 56 above, and consequently neither dependent claims 68-69 and 76-80.

Conclusion

In light of the foregoing, Applicant respectfully submits that all claims are patentable, and kindly solicits and early and favorable Notice of Allowability.

THIS CORRESPONDENCE IS BEING SUBMITTED ELECTRONICALLY THROUGH THE PATENT AND TRADEMARK OFFICE EFS FILING SYSTEM ON OCTOBER 14, 2008

Respectfully submitted,

David J. Torrente

Registration No.: 49,099
OSTROLENK, FABER, GERB & SOFFEN, LLP
1180 Avenue of the Americas
New York, New York 10036-8403
Telephone: (212) 382-0700

{00971339.1}